



## PATENT SPECIFICATION

NO DRAWINGS

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## COMPLETE SPECIFICATION

## Improving the Properties of Refractory Fibres

We, FOSECO INTERNATIONAL LIMITED, a British Company of 285 Long Acre, Nechells, Birmingham 7, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to improving the properties of refractory fibres and shaped fibre containing compositions.

Three principal types of refractory fibre are of value in the foundry industry: calcium silicate, aluminium silicate and aluminosilicate fibres. Although not easily or cheaply available in their pure forms, these fibres are extensively used in the forms of various grades of slag and mineral wool.

Whilst these materials have high softening points and melting points (calcium silicate has a softening point about 800-1100° and melting point 900-1100°C. similarly, aluminosilicate has a softening point of 1350-1700°C and a melting point 1550-1700°C), their mechanical properties at high temperatures below their softening points are in some ways deficient. This is particularly so in the case of crush resistance of matted masses of such fibrous materials.

In the foundry and steelmaking industries, in the use of refractory heat insulating materials which are designed to be contacted by molten metal, it has long been desired to replace at least part of the normal asbestos content of such materials by a refractory fibre such as one of those noted above.

Such compositions containing a proportion of calcium silicate, aluminium silicate or aluminosilicate fibre do not, however, possess good crush resistance, and are therefore susceptible to molten metal penetration or even to collapse under the action of metallostatic pressure.

It is an object of this invention to provide a method of upgrading refractory fibrous materials, to increase, *inter alia*, their crush resistance.

According to a first feature of the present invention there is provided a process for the treatment of synthetic fibrous refractory material which comprises applying to the surface of the synthetic refractory fibre a coating of a refractory oxide or an aluminium phosphate, or a compound which on heating will generate a refractory oxide or an aluminium phosphate, and drying and firing the fibres.

Synthetic fibrous materials which may be upgraded in this way include calcium silicate, silica, aluminium silicate, and aluminosilicate.

Preferred refractory oxides are silica usually used in the form of a colloidal dispersion, e.g. silica sol, and chromic oxide. The preferred aluminium phosphate is aluminium orthophosphate. More than one of these oxides and phosphates may be applied to the fibres to be treated.

The preferred treatment method is to form a solution or suspension of the oxide or aluminium phosphate, preferably in an aqueous solution, although organic solvents may be used, coat the fibres to be treated with the solution, and dry and fire the fibres.

In some cases the treatment solution or suspension may tend to attack the fibrous material itself—for example, calcium silicate fibres are attacked by acid phosphates. In such a case it is desirable prior to the coating operation of this invention to provide the fibres with a protective coating—for example of a synthetic resin such as phenolformaldehyde or furane resins or polyacrylonitrile.

After the treatment just described the ease with which the synthetic fibrous refractory materials may be worked is greatly diminished, and it is therefore desirable to apply the solution or suspension treatment to products containing the synthetic fibres rather than to raw fibres *per se*.

According to a further feature of the present invention therefore, there is provided a process for treating shaped synthetic refractory fibre containing compositions

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which comprises impregnating such compositions with a refractory oxide or an aluminium phosphate, or a compound which on heating will generate a refractory oxide or an aluminium phosphate, and drying and firing the said composition.

A particularly useful process of this nature is the treatment of felted refractory fibre shapes, e.g. sleeves for use as liners for casting or ingot moulds, to improve their crush resistance and other mechanical properties. Such shapes may consist solely of refractory fibre, or may include a filler such as coke dust.

The particle size of any suspended refractory material in the treatment solution or suspension used is preferably less than —200 mesh B.S.S. Particularly preferred treatment media are:

(a) an aqueous solution of aluminium orthophosphate having in suspension a proportion of —200 mesh BSS chromite flour or zircon flour

(b) aqueous silica sol having a proportion of —200 mesh BSS chromite flour or zircon flour suspended therein.

The following examples will serve to illustrate the invention:—

#### Example I

A bonded alumino-silicate fibre (calcined kaolin) riser sleeve was impregnated with aluminium orthophosphate gel, dried in air to prevent surface migration of the impregnant and then fired at about 180°C.

The treatment sleeve was used as the riser head on a steel casting and as a comparison an untreated sleeve was used on an identical casting. It was found that the treated sleeve resisted metal penetration, veining and sintering to a significantly higher degree than the untreated sleeve.

#### Example II

Example I was repeated except that the sleeve was impregnated with a solution of aluminium orthophosphate containing a proportion of —200 BSS mesh zircon flour. Tests proved this treatment to be as effective as that described in Example I.

#### Example III

A calcium silicate fibre sleeve containing fine coke dust as a filler was coated with a solution of aluminium orthophosphate. The coating penetrated the sleeve which was subsequently fired at about 180°C thus modifying the surface layer of the sleeve.

In normal use a calcium silicate fibre sleeve would be completely disintegrated by the erosive effect of the molten steel. However, sleeves treated according to Example III were sufficiently upgraded to withstand the effects of molten steel for several minutes,

with the structure of the sleeves still being discernible at the end of the casting operation.

#### WHAT WE CLAIM IS:—

1. A process for the treatment of synthetic fibrous refractory material which comprises applying to the surface of the synthetic refractory fibre, a coating of a refractory oxide or an aluminium phosphate, or a compound which on heating will generate a refractory oxide or an aluminium phosphate and drying and firing the fibres.

2. A process according to claim 1 which comprises, prior to applying the said coating, the step of coating the fibres with a protective layer.

3. A process according to claim 2 wherein the protective layer is of a synthetic resin.

4. A process according to claim 3 wherein the synthetic resin is a phenol formaldehyde, furane or polyacrylonitrile resin.

5. A process for treating shaped synthetic refractory fibre containing compositions which comprises impregnating such compositions with a refractory oxide or an aluminium phosphate, or a compound which on heating will generate a refractory oxide or an aluminium phosphate, and drying and firing the said composition.

6. A process according to claim 5 wherein the synthetic refractory fibre bears on its surface a protective resinous coating.

7. A process according to claim 5 or 6 wherein the shaped composition is a riser sleeve for metal casting.

8. A process according to any of claims 1-7 which comprises treating the fibre or fibre containing composition with a suspension or solution of a refractory oxide or an aluminium phosphate, and drying and firing the so-treated fibre or composition.

9. A process according to claim 8 wherein said suspension or solution is aqueous.

10. A process according to claim 8 or 9 wherein there is used a suspension of particulate refractory oxide having a particle size such that all passes a 200 BSS mesh.

11. A process according to claim 10 wherein there is used an aqueous solution of an aluminium phosphate, having chromite flour or zircon flour suspended therein.

12. A process according to claim 10 wherein there is used an aqueous silica sol having chromite flour or zircon flour suspended therein.

13. A process according to any of claims 1-12 wherein aluminium orthophosphate is used.

14. A process according to any of claims 1-13 wherein the synthetic refractory fibre is calcium silicate, silica, aluminium silicate or alumino silicate fibre.

15. A process for treating synthetic fibrous refractory material or shaped com-

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positions containing the same substantially as hereinbefore described with reference to any one of the foregoing specific examples.

any of the processes hereinbefore described and claimed.

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5 16. Synthetic refractory fibre whenever produced by any of the processes hereinbefore described and claimed.

17. Synthetic refractory fibre containing shaped compositions whenever produced by

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